A Note on Block Transactions in Futures Markets: International Evidence

Alex Frino
Futures Industry Research Centre Director
Professor of Finance
University of Sydney

Jennifer Kruk
PhD candidate
University of Sydney

Andrew Lepone
Futures Industry Research Centre Assistant Director
Lecturer
University of Sydney

Abstract

This paper is the first international study of price impact in futures markets. We examine price behaviour surrounding block trades in fifteen stock index futures contracts. Results indicate that price behaviour surrounding large trades varies across markets. Although there is some degree of price slippage surrounding large trades in all contracts, several contracts are associated with price reversals while other contracts exhibit significant information effects. Contrasting with equity market literature, price behaviour surrounding purchases and sales is symmetric. Results are robust to alternative measures of price impact and after controlling for normal market behaviour using a control sample.

Acknowledgements: This research was funded by the Sydney Futures Exchange under Corporations Regulation 7.5.88(2). The authors wish to thank participants at the Sydney Futures Exchange seminar series for their insightful comments. Reuters data is provided by the Securities Industry Research Centre of Asia-Pacific (SIRCA).

1. Introduction

In recent years international portfolios have become essential investment tools for institutional investors worldwide[1] and in turn have generated an increase in the use of derivative products. When considering an international portfolio investment strategy, transaction cost estimation is crucial. One important component of transaction costs is price impact, which measures how much the transaction price diverges from an unperturbed price independent of the trade. The unperturbed price is the price that would have prevailed had the trade not executed (Domowitz, Glen and Madhavan, 2001). Price impact, or *slippage* as it is commonly known in futures markets, has negligible coverage in futures microstructure literature. Contrasting with equity markets, there are few empirical studies that examine slippage incurred by trading futures and none that examine slippage across different countries.

Scholes (1972) and Kraus and Stoll (1972) originally discuss three possible reasons for price impact in equity markets. First, prices may move due to short-run liquidity costs. This involves prices temporarily deviating from their equilibrium value to a market-clearing level, and is associated with a price reversal. Second, prices may move as a result of a distribution effect related to the inelastic demand for securities. When this occurs, prices may slowly revert back to their original level or remain at a new level. Third, prices can move as a response to new information. This involves a change in the fundamental value of a security, and is associated with a permanent price change.

[1] Chiyachantana, Jain, Jiang and Wood (2004) discuss the increasing importance of international portfolios to institutional investors.

One implication of the distribution hypothesis is that block size should be positively correlated with price impact. Kraus and Stoll (1972) test this hypothesis and find for purchases and sales block size is significantly positively correlated with price impact, and the correlation is stronger for down-tick blocks (sales).[2] Other empirical studies that report a relationship between trade size and price impact include Holthausen, Leftwich and Mayers (1987, 1990) and Chan and Lakonishok (1993, 1995). Empirical studies in futures markets find similar results to those in equity markets. Frino and Oetomo (2005) on the Sydney Futures Exchange and Berkman, Brailsford and Frino (2005) on the London International Financial Futures and Options Exchange both find that slippage increases with trade size.

Holthausen, Leftwich and Mayers (1990) test whether the permanent price effect observed in block trades is related to the size of the trade. They find that for purchases and sales, large trades incur a significant permanent price effect after controlling for normal market behaviour with a non-block control group. Thus far, empirical evidence in futures markets does not support their findings. Berkman et al. (2005) find that large trades do not carry information, while Frino and Oetomo (2005) find that institutional trade packages are not informed.

Empirical equity market studies also consistently find an asymmetry between price impact components for purchases and sales. Numerous equity market studies find that purchases are associated with permanent price effects and sales are associated with both temporary and permanent price effects.[3] The literature offers varied explanations

[2] Easely and O'Hara (1987) and Glosten (1989) also discuss the theoretical relationship between trade size and price impact.
[3] Some studies that have found an asymmetry between purchases and sales include Kraus and Stoll (1972), Holthausen et al. (1987, 1990) and Chan and Lakonishok (1993, 1995).

for these differences. Some common explanations include the reluctance of traders in equity markets to go short to facilitate a buyer-initiated trade, and a greater number of liquidity-motivated reasons to sell a security as opposed to buying it (Chan and Lakonishok, 1993).[4] Contrasting with equity markets, purchases and sales behave symmetrically in futures markets. Both Berkman et al. (2005) and Frino and Oetomo (2005) find no difference between temporary and permanent price effects associated with purchases and sales. They attribute this to the symmetrical costs of long and short positions in futures markets.

There are several equity market studies that examine price impact across countries.[5] To date, there is a dearth in international empirical evidence regarding the components of slippage in futures markets. The primary aim of this study is to extend the methodology applied to equity markets into an international futures market setting. More specifically, we test (i) if block trades incur total and permanent price effects (slippage and information respectively) once controlling for normal market behaviour and (ii) asymmetrical price effects between purchases and sales.

The remainder of this study is organised as follows. Section 2 describes the data and methodology. Sections 3 and 4 present results and several additional tests respectively, while the paper is summarised in Section 5. The Appendix contains details of contract specifications.

[4] Chiyachantana, Jain, Jiang and Wood (2004) provide an alternative explanation for the asymmetry between purchases and sales. They find that the underlying state of the market (bull or bear) is a major determinant of both price impact and the asymmetry between purchases and sales.
[5] Some examples include Perold and Sirri (1998), Domowitz, Glen and Madhavan (2001), Jain (2002), Chiyachantana et al. (2004) and Aitken, Cook, Harris and McInish (2006).

2. Data and Methodology

The data used in this study are sourced from Reuters and contains all transactions in 15 stock index futures from January 1, 2001 to December 31, 2005. The sample includes trades from the DAX, FTSE100, CAC40, OMXS30, S&P500 Globex®, H-Share Index, Hang Seng Index, KOSPI 200, MSCI Singapore, MSCI Taiwan, SPI 200, TOPIX, Nikkei 225 (OSE), Nikkei 225 (SGX) and TAIEX stock index futures contracts. The fields available for analysis include date, time, price, volume, best bid and best ask. Bid and ask quotes are the prevailing best quotes immediately prior to the trade.

Trades are classified as buyer- or seller-initiated using the classification algorithm from Ellis, Michaely and O'Hara (2000).[6] In this algorithm, trades are initially classified using a quote-based rule. Trades executed at the best ask are classified as buyer-initiated and trades occurring at the best bid are classified as seller-initiated. Any trades not captured by this classification rule are classified using a tick rule, where trades occurring on an up-tick are classified as buyer-initiated and trades occurring on a down-tick are classified as seller-initiated. Any remaining unclassified trades are excluded from the sample.[7]

The sample is restricted to electronic trading in the near contract during daytime trading hours.[8] Trades occurring on the expiration day of the near contract are excluded, as are trades that meet the minimum criteria for off-market block

[6] This classification algorithm is similar to the algorithm of Lee and Ready (1991).
[7] Over 99 percent of trades in the sample are classified using this algorithm.
[8] The exception for this is S&P500 stock index futures. This contract is traded on the floor during daytime hours, and traded electronically through Globex® overnight.

transactions.[9] Most exchanges have a facility for trading large blocks off-market. Transactions that meet off-market size requirements are removed from the sample as they arrive to the market crossed and in some instances reporting is delayed. These trades incur no slippage.

The pre- and post-trade benchmarks employed in this study to measure slippage are the transaction prices five trades before and five trades after the block trade; analogous to the benchmarks used in Berkman et al. (2005). The calculation of total, temporary and permanent price effects is consistent with Chan and Lakonishok (1993). *Slippage* measures the total price impact of a trade, and can be decomposed into temporary *(Liquidity)* and permanent *(Information)* price effects, as follows –

$$Slippage_{i,t} = \left[\frac{Price_t - Price_{t-5}}{Price_{t-5}} \right] * 100 \quad (1)$$

$$Liquidity_{i,t} = \left[\frac{Price_{t+5} - Price_t}{Price_t} \right] * 100 \quad (2)$$

$$Information_{i,t} = \left[\frac{Price_{t+5} - Price_{t-5}}{Price_{t-5}} \right] * 100 \quad (3)$$

For each trade, $Price_t$ is the transaction price, $Price_{t-5}$ is the price five trades preceding the trade, and $Price_{t+5}$ is the price five trades after the trade.

We examine total, temporary and permanent price effects for the largest two percent of trades in each contract (block trades), and create a control group consisting of one-

[9] Frino and McKenzie (2002) document abnormal price behaviour in the period prior to contract expiration. We remove trades on the contract expiration day to remove potential bias from the sample as traders roll their positions from the near to deferred contract. Consistent with Frino and McKenzie (2002), we also exclude trades within ten days of expiration of the near contract and results are consistent. These results are available on request.

lot trades. Each block trade is matched with a one-lot transaction of the same classification (buy or sell) by searching prior to trade -16 relative to the block trade. This matching technique is consistent with Holthausen, Leftwich and Mayers (1990). The control group provides a benchmark return and allows calculation of abnormal returns for block trades. Section 3 reports raw returns for the block group and abnormal returns using the control group benchmark.

Table I presents descriptive statistics for block trades in the fifteen stock index futures contracts examined in this study. Panel A reports statistics for buys and Panel B reports statistics for sells. There are significant differences in sample sizes between contracts. The DAX, FTSE100, CAC40, and KOSPI 200 have sample sizes greater than 100,000 for block buys and sells; the Hang Seng, SPI 200, TOPIX, Nikkei 225 (OSE), and TAIEX have sample sizes for buys and sells greater than 20,000 and below 100,000; and the OMXS30, S&P500 Globex®, H-Share, MSCI Singapore, MSCI Taiwan and Nikkei 225 (SGX) have sample sizes less than 20,000 for both block buys and sells.

<INSERT TABLE I HERE>

Panels A and B of Table I report mean, median and standard deviations for trade volume and notional trade value in US Dollars.[10] The sample has a large range in mean trade volume. OMXS30 futures have the greatest average volume of 1,164.01 contracts and MSCI Singapore futures have the lowest average volume of 9.67 contracts. The mean notional trade value also has a large range, with values ranging

[10] Notional trade value is calculated as [*price*volume*index multiplier*fx rate*] where *price* is the trade price, *volume* is the number of contracts, *index multiplier* is the dollar value per index point as reported in Table A1 and *fx rate* is the daily USD exchange rate provided by the US Federal Reserve.

from USD 0.46 million for MSCI Singapore futures up to USD 9.256 million for OMXS30 futures.[11] Overall, buyer- and seller-initiated transactions across all markets are relatively similar. Any differences between these types of transactions are not likely to drive any differences in results.

3. Results

There are three potential price paths following execution of a block trade that incurs slippage. First, prices may revert back to original levels, indicating slippage is entirely a liquidity cost. Second, prices may exhibit a partial price reversal, providing evidence slippage is part liquidity cost and part information. Third, prices may continue in the direction of the trade, suggesting strong information effects. Table II reports slippage, liquidity and information estimates for block purchases and block sales.

<INSERT TABLE II HERE>

In Table II, FTSE 100 futures and Nikkei 225 (OSE) futures both have a complete price reversal following block buys and sells; slippage incurred by large trades in these contracts is entirely a liquidity cost.[12] Berkman et al. (2005) also examine slippage for trades in FTSE 100 futures, and the price reversal reported in Table II is consistent with their results for large trades. DAX and KOPSI200 futures also have price reversals following both buys and sells. However, the magnitude of the reversal

[11] OMXS30 futures do not have an off-market block trading facility. This explains the large mean and variance for trades in this contract.

[12] Examining buys only, FTSE 100 and Nikkei 225 (OSE) futures appear to have a significant information variable. However, the direction of the variable indicates that the price has reverted back past its original level. A negative information effect for buys and a positive information effect for sells is analogous to no information.

following buys is sufficient to make the information effect insignificantly different from zero, while sales only exhibit a partial price reversal and thus have a significant information effect.

Several contracts have on average a partial price reversal for block buys and block sells in Table II. These include the CAC40, OMXS30, H-Share Index, Hang Seng Index, TOPIX and TAIEX. In these contracts both liquidity and information variables are significantly different from zero, indicating slippage is partially a liquidity cost and partially due to information effects. Interestingly, block buys and sells in both the S&P500 Globex® traded futures and Nikkei 225 (SGX) futures have a liquidity effect insignificantly different from zero and thus a significant information effect.

Finally, several contracts exhibit price continuations. The MSCI Singapore, MSCI Taiwan and SPI 200 futures contracts all have a significant liquidity effect in the same direction as the slippage variable, and results are symmetrical for buys and sells. Block trades in these contracts have an information effect significantly different from zero.

Table III reports abnormal returns for the largest two percent of trades in each contract. The benchmark for calculating abnormal returns is the return on a control group of matched one-lot trades. If block trades incur greater slippage than the control group, abnormal returns will be positive for buys and negative for sells. However, if slippage is negative (positive) for buys (sells), this indicates that block trades incur slippage no greater than one-lot trades. This interpretation also holds for the information variable.

< INSERT TABLE III HERE >

Block trades in the majority of contracts in Table III incur slippage significantly greater than the control group. The DAX, CAC40, OMXS30, S&P500 Globex®, H-Share Index, Hang Seng Index, MSCI Taiwan, SPI 200, Nikkei 225 (SGX) and TAIEX all have positive abnormal slippage for buys and negative abnormal slippage for sells. However, there are several contracts in which block trades do not incur slippage greater than the control group. The FTSE100, KOPSI 200, MSCI Singapore, TOPIX and Nikkei 225 (OSE) incur negative abnormal slippage for buys and positive abnormal slippage for sells. Investors that execute on-market block trades in these contracts incur slippage no greater than if they executed a one-lot transaction.

The majority of contracts in Table III also have an information effect for block trades significantly greater than the control group. The CAC40, OMXS30, S&P500 Globex®, Hang Seng Index, MSCI Singapore, MSCI Taiwan, SPI 200, TOPIX, Nikkei 225 (SGX) and TAIEX have positive abnormal information for buys and negative abnormal information for sells. Conversely, FTSE100, H-Share and Nikkei 225 (OSE) futures have information effects for buys and sells no different from the control group of one-lot trades. Consistent with Table II, the magnitude of the information effect for DAX and KOSPI 200 futures differs for buys and sells. Block buys in these contracts contain no more information than one-lot buys; however, block sells contain more information than one-lot sells.

4. Additional Tests

This section discusses various robustness tests employed to confirm results presented in Section 3. We repeat the study using midpoint quotes, an alternative definition of execution costs and alternative pre- and post-trade benchmarks.[13]

Koski and Michaely (2000) recognise a potential bid-ask bias when measuring price impact using transaction prices.[14] To overcome this potential problem, they also calculate price impact using quoted returns. To test whether price movements reported in this study capture bid-ask bounce, we recalculate Equations 1 to 3 using midpoint quotes instead of transaction prices. Results in this study are consistent when midpoint quotes are used to measure returns for the slippage, liquidity, and information variables. This confirms price effects reported in Section 3 are not driven by bid-ask bounce.

Berkman et al. (2005) also document slippage incurred by single trades in futures markets, however, their calculations of total, temporary and permanent price effects are different to calculations in this study. The second test ensures results are consistent with Berkman et al. (2005) and provides an additional test of the technique employed to measure total, temporary and permanent price effects in block trades. In this analysis, effective half spreads, realised spreads and permanent price effects are synonymous with slippage, liquidity and information respectively. These alternative measures of price impact and its components are taken directly from Berkman et al. (2005) and are calculated as

[13] For space considerations, results from robustness tests are not reported but are available on request.
[14] Numerous studies recognise a potential bid-ask bias when using returns calculated with transaction prices, including Vijh (1988), Foerster, Keim & Porter (1990), Lease, Masulis & Page (1991), Bhardwaj & Brooks (1992), Gosnell, Keown and Pinkerton (1996) and Rhee and Wang (1997).

$$Effective\ half\ \ spread = 100 D_i \ln(Price_i / MQBefore_i) \quad (4)$$

$$Realised\ half\ \ spread = 100 D_i \ln(Price_i / MQAfter_i) \quad (5)$$

$$Permanent\ \ price\ impact = 100 D_i \ln(MQAfter_i / MQBefore_i) \quad (6)$$

where D_i is a binary variable that equals 1 for buys and -1 for sells, $Price_i$ is the value-weighted average price of the trade, $MQBefore_i$ is the mid-quote five trades before the block trade, and $MQAfter_i$ is the mid-quote five trades after the block trade. Results using these alternative measures are consistent with original findings. Several contracts incur price impact which is permanent, while other contracts are associated with only temporary price impact.

Chan and Lakonishok (1993, 1995) recognise the importance of benchmark selection in price impact studies. The final test examines the choice of benchmark by replacing the 5-trade benchmark used in Equations 1 to 6 with 10-trade benchmarks. Changing the pre- and post-trade benchmark does not significantly change results. Results are thus robust to the choice of pre- and post-trade benchmarks.

5. Conclusions

This paper conducts the first international study of slippage incurred by block trades in futures markets. The paper examines the price impact in 15 stock index futures contracts, providing evidence of statistically significant slippage associated with block trades in all contracts. Several contracts exhibit complete price reversals, several contracts are associated with partial price reversals, while the remaining contracts exhibit price continuations. The magnitude of the price reversal for DAX and KOSPI

200 futures is larger in block buys than block sells. Consistent with futures market literature, there is no asymmetry between block purchases and block sales.

Once controlling for normal market behaviour using a matched sample of one-lot trades, block trades in several contracts no longer incur statistically significant slippage. Block trades in the FTSE100, KOPSI 200, MSCI Singapore, TOPIX and Nikkei 225 (OSE) incur slippage no greater than the control group. Information effects reported in block trades still hold once returns are adjusted for normal market behaviour.

This paper provides a preliminary analysis of slippage and its components; liquidity and information, in a selection of stock index futures. Many potential avenues for future research arise from results presented here. For example, analysis of the determinants of slippage may formally highlight why block trades in some contracts contain information and others do not. The differing information content of buys and sells for DAX and KOSPI 200 futures also warrants future research, as thus far no explanation for this difference exists.

Bibliography

Aitken, M. J., R. M. Cook, F. B. Harris, and T. H. McInish, 2006, "Market Design and Execution Costs for Matched Securities across Seven Tier-One Markets," *Working paper, UNSW*

Berkman, H., T. Brailsford, and A. Frino, 2005, "A note on execution costs for stock index futures: Information versus liquidity effects," *Journal of Banking and Finance,* 29, 565-577.

Bhardwaj, R. K. and L. D. Brooks, 1992, **"**The January Anomaly: Effects of Low Share Price, Transaction Costs, and Bid-Ask Bias," *Journal of Finance,* 47(2), 553-575.

Chan, K.C., and J. Lakonishok, 1993, "Institutional Trades and Intraday Stock Price Behavior," *Journal of Financial Economics,* 33, 173-199.

Chan, L.K.C., and J. Lakonishok, 1995, "The Behavior of Stock Prices Around Institutional Trades," *Journal of Finance*, 50, 1147-1174.

Chiyachantana, C. N., P. K. Jain, C. Jiang, and R. A. Wood, 2004, " International Evidence on Institutional Trading Behavior and Price Impact," *Journal of Finance,* 54(2), 869-898.

Domowitz, I., J. Glen and A. Madhavan, 2001, "Liquidity, Volatility and Equity Trading Costs across Countries and Over Time," *International Finance*, 4(2), p.221-255.

Easely, D. and M. O'Hara, 1987, "Price, Trade Size, and Information in Securities Markets," *Journal of Financial Economics,* 19, 69-90.

Ellis, K., R. Michaely and M. O'Hara, 2000, "The Accuracy of Trade Classification: Evidence from Nasdaq," *Journal of Financial and Quantitative Analysis,* 35(4), 529-551.

Foerster, S.D., Keim, D.B. and Porter, D.C., 1990, "Intraday Spreads, Returns and Variances: Tests of the Informed Trader Hypothesis," *Unpublished Working Paper*, University of Western Ontario.

Frino, A. and M. D. McKenzie, 2002, "The pricing of stock index futures spreads at contract expiration," *Journal of Futures Markets,* 22 (5), 451-469.

Frino, A., and T. Oetomo, 2005, "Slippage in Futures Markets: Evidence from the Sydney Futures Exchange," *The Journal of Futures Markets,* 25(12), 1129-1146.

Glosten, L., 1989, "Insider Trading, Liquidity, and the Role of the Monopolist Specialist," *Journal of Business,* 62, 211-236.

Gosnell, T. F., A. J. Keown and J. M. Pinkerton, 1996, "The intraday speed of stock price adjustment to major dividend changes: Bid-ask bounce and order flow imbalances," *Journal of Banking and Finance,* 20, 247-266.

Holthausen, R., R Leftwich, and D. Mayers, 1987, "The Effect of Large Block Transactions on Security Prices: A Cross-Sectional Analysis," *Journal of Financial Economics,* 19, 237-267.

Houlthausen, R., R. Leftwich, and D. Mayers, 1990, "Large-Block Transactions, the Speed of Adjustment, and Temporary and Permanent Stock-Price Effects," *Journal of Financial Economics,* 26, 71-95.

Jain, P.K., 2002, "Institutional design and liquidity at stock exchanges around the world," *Working Paper,* University of Memphis.

Koski, J. L. and R. Michaely, 2000, "Prices, Liquidity and the Information Content of Trades," *Review of Financial Studies,* 13(3), 659-696.

Kraus, A., and H. Stoll, 1972, "Price impacts of block trading on the New York Stock Exchange," *Journal of Finance,* 27, 569-588

Lease, R., Masulis, R. and Page, J., 1991, "An Investigation of Market Microstructure Impacts on Event Study Returns," *Journal of Finance*, 46, 1523-1536.

Lee, C. M. C. and M. J. Ready, 1991, "Inferring Trade Direction from Intraday Data," *Journal of Finance,* 46(2), 733-746.

Perold, A. F., and E. Sirri, 1998, "The cost of international equity trading," *Working Paper,* Harvard University.

Rhee, S. G. and C. J. Wang, 1997, "The bid-ask bounce effect and the spread size effect: Evidence from the Taiwan Stock Market," *Pacific-Basin Finance Journal,* 5(2), 231-258.

Scholes, M.S., 1972, "The Market for Securities: Substitution versus Price Pressure and the Effects of Information on Share Prices," *Journal of Business,* 45(2), 179-211.

Vijh, A. M., 1988, "Potential Biases from Using Only Trade Prices of Related Securities on Different Exchanges: A Comment," *Journal of Finance,* 43(4), 1049-1055.

Appendix A1 Contract Specifications

<INSERT TABLE A1 HERE>

Table I
Descriptive Statistics: Block Trades

Panel A: Buys

	Volume Traded (no. contracts)			Notional Trade Value (USD '000s)			
Contract	*Mean*	*Median*	*Std dev.*	*Mean*	*Median*	*Std dev.*	*N*
DAX	74.34	47.00	58.60	7,119.90	4,494.31	6,539.64	235,064
FTSE100	71.46	40.00	103.41	3,828.30	2,223.31	6,605.42	250,916
CAC40	64.65	49.00	46.55	1,685.65	1,387.08	1,734.09	204,489
OMXS30	1,085.08	387.00	2,688.06	8760.04	2,737.53	20,541.07	2,411
S&P500 Globex®	30.41	19.00	197.75	6,445.94	4,076.06	46,062.40	17,540
H-Share	36.40	32.00	13.77	958.10	891.66	510.52	8,713
Hang Seng	34.88	30.00	15.99	1,890.79	1,910.28	1,479.17	91,294
KOSPI 200	271.80	230.00	125.96	8,936.76	8,533.71	6,407.01	208,755
MSCI Singapore	9.67	8.00	6.01	194.74	174.91	174.15	15,304
MSCI Taiwan	26.39	21.00	12.87	467.09	486.18	365.82	8,283
SPI200	33.96	28.00	18.36	1,164.81	1,017.84	1,202.62	25,038
TOPIX	59.77	52.00	13.72	5,660.69	5,513.28	2,082.38	23,997
Nikkei 225 (OSE)	79.56	79.00	10.74	7,009.30	7,064.30	2,043.25	25,428
Nikkei 225 (SGX)	73.10	60.00	33.54	2,374.35	2,587.73	2,129.04	5,021
TAIEX	34.88	30.00	15.99	1,890.79	1,910.21	1,479.16	91,294

Table I continued

Panel B: Sells

	Volume Traded (no. contracts)			Notional Trade Value (USD '000s)			
Contract	*Mean*	*Median*	*Std dev.*	*Mean*	*Median*	*Std dev.*	*N*
DAX	69.34	40.00	59.63	7,237.10	4,530.18	6,725.30	142,070
FTSE100	69.04	40.00	100.49	4,088.29	2,478.74	6,739.70	156,892
CAC40	62.29	48.00	43.63	1,851.93	1,581.27	1,661.57	141,443
OMXS30	1,164.01	400.00	2,698.81	9,256.18	2,966.26	21,567.18	2,506
S&P500 Globex®	40.07	19.00	704.21	8,929.75	4,045.65	198,098.59	18,101
H-Share	36.53	32.00	13.39	954.45	897.05	511.07	8,853
Hang Seng	34.78	30.00	16.07	1,863.99	1,889.14	1,473.52	92,634
KOSPI 200	271.19	230.00	156.85	8,880.50	8,484.03	7,044.86	216,453
MSCI Singapore	9.68	8.00	6.59	46.51	168.34	179.18	14,969
MSCI Taiwan	26.63	21.00	13.61	466.02	479.38	383.21	7,976
SPI200	34.06	28.00	18.89	1,179.46	1,017.35	1,266.28	24,548
TOPIX	59.75	51.00	13.84	5,659.67	5,511.35	2,110.19	23,024
Nikkei 225 (OSE)	79.46	79.00	10.69	6,952.28	7,004.48	2,025.27	25,765
Nikkei 225 (SGX)	72.28	60.00	32.96	2,325.92	2,584.08	2,038.73	4,865
TAIEX	34.78	30.00	16.07	1,863.99	1,889.14	1,473.52	92,634

Note: This table reports descriptive statistics for block trades in the 15 stock index futures contracts examined in this study. Block trades represent the largest two percent of trades in each contract after removing trades that meet the minimum volume threshold for off-market block transactions. Panel A reports statistics for buys and Panel B reports statistics for sells. The mean, median and standard deviation is reported for volume traded and notional trade value. Volume traded is the average number of contracts per trade. Notional trade value is calculated as [*price*volume*index multiplier*fx rate*] where *price* is the trade price, *volume* is the number of contracts, *index multiplier* is the dollar value per index point as reported in Table A1 and *fx rate* is the daily exchange rate to USD as provided by the US Federal Reserve.

Table II
Slippage, Liquidity and Information Returns for Block Trades

	Slippage		Liquidity		Information	
Contract	*Buys*	*Sells*	*Buys*	*Sells*	*Buys*	*Sells*
DAX	0.0045**	-0.0063**	-0.0043**	0.0047**	0.0002	-0.0016**
FTSE100	0.0021**	-0.0028**	-0.0042**	0.0044**	-0.0021**	0.0016**
CAC40	0.0075**	-0.0068**	-0.0037**	0.0024**	0.0038**	-0.0044**
OMXS30	0.0177**	-0.0176**	-0.0073**	0.0087**	0.0104**	-0.0089**
S&P500 Globex®	0.0227**	-0.0252**	-0.0008	0.0007	0.0219**	-0.0245**
H-Share	0.0257**	-0.0240**	-0.0085**	0.0063**	0.0172**	-0.0177**
Hang Seng	0.0117**	-0.0123**	-0.0060**	0.0058**	0.0057**	-0.0065**
KOSPI 200	0.0107**	-0.0112**	-0.0106**	0.0101**	0.0001	-0.0011**
MSCI Singapore	0.0206**	-0.0197**	0.0045**	-0.0030**	0.0251**	-0.0227**
MSCI Taiwan	0.0155**	-0.0153**	0.0007*	-0.0007*	0.0162**	-0.0160**
SPI200	0.0158**	-0.0155**	0.0032**	-0.0033**	0.0190**	-0.0188**
TOPIX	0.0103**	-0.0091**	-0.0060**	0.0056**	0.0043**	-0.0035**
Nikkei 225 (OSE)	0.0162**	-0.0154**	-0.0188**	0.0179**	-0.0026**	0.0025**
Nikkei 225 (SGX)	0.0122**	-0.0111**	-0.0005	0.0009	0.0117**	-0.0102**
TAIEX	0.0117**	-0.0123**	-0.0060**	0.0058**	0.0057**	-0.0065**

* Significantly different from zero at the 5% level ** Significantly different from zero at the 1 % level

Note: This table reports unadjusted returns surrounding block trades for each of the 15 contracts examined in this study. Block trades represent the largest two percent of trades in each contract after removing trades that meet the minimum threshold for off-market block transactions. *Slippage* is the return from the price five trades prior to the trade to the trade price. *Liquidity* is the return from the trade price to price five trades after the trade. *Information* is the return from the price five trades prior to the trade to the price five trades after the trade. All returns are reported as percentages. A *t*-test is used to test the deviation of mean values from zero.

Table III
Abnormal Slippage, Liquidity and Information Returns for Block Trades

	Slippage		Liquidity		Information	
Contract	*Buys*	*Sells*	*Buys*	*Sells*	*Buys*	*Sells*
DAX	0.0005**	-0.0006**	-0.0010**	-0.0001	-0.0005**	-0.0007**
FTSE100	-0.0004**	0.0010**	-0.0017**	0.0006**	-0.0021**	0.0016**
CAC40	0.0033**	-0.0017**	-0.0018**	0.0000	0.0015**	-0.0017**
OMXS30	0.0087**	-0.0086**	-0.0020*	0.0030**	0.0067**	-0.0056**
S&P500 Globex®	0.0163**	-0.0190**	-0.0001	0.0000	0.0162**	-0.0190**
H-Share	0.0063**	-0.0052**	-0.0055**	0.0032**	0.0008	-0.0020
Hang Seng	0.0037**	-0.0048**	-0.0025**	0.0024**	0.0012**	-0.0024**
KOSPI 200	-0.0017**	0.0002**	0.0037**	-0.0006**	0.0020	0.0008**
MSCI Singapore	-0.0014**	0.0016**	0.0058**	-0.0041**	0.0044**	-0.0025**
MSCI Taiwan	0.0053**	-0.0051**	0.0043**	-0.0042**	0.0096**	-0.0093**
SPI200	0.0051**	-0.0051**	0.0070**	-0.0072**	0.0121**	-0.0123**
TOPIX	-0.0025**	0.0038**	0.0072**	-0.0072**	0.0047**	-0.0034**
Nikkei 225 (OSE)	-0.0072**	0.0085**	0.0055**	-0.0069**	-0.0017**	0.0016**
Nikkei 225 (SGX)	0.0027**	-0.0018**	0.0048**	-0.0046**	0.0075**	-0.0064**
TAIEX	0.0037**	-0.0048**	-0.0025**	0.0024**	0.0012**	-0.0024**

* Significantly different zero at the 5% level ** Significantly different from zero at the 1% level

Note: This table reports abnormal returns surrounding block trades for each of the 15 contracts examined in this study. Block trades represent the largest two percent of trades in each contract after removing trades that meet the minimum threshold for off-market block transactions. Abnormal returns are returns for block trades in excess of returns on a matched control sample of one-lot trades. Matched trades are selected by searching prior to trade -16 relative to the block. *Slippage* is the return from the price five trades prior to the trade to the trade price. *Liquidity* is the return from the trade price to price five trades after the trade. *Information* is the return from the price five trades prior to the trade to the price five trades after the trade. All returns are reported as percentages. A difference of means *t*-test is used to test whether the mean difference between the block and control group is significantly different from zero.

Table A1
Contract Specifications

Contract	Exchange	Minimum tick	Notional value per index point
DAX	Eurex	0.5 points	EUR 25
FTSE100	Euronext.liffe	0.5 points	GBP 10
CAC40	Euronext.liffe	0.5 points	EUR 10
H-Share	HKE	1 point	HKD 50
Hang Seng	HKE	1 point	HKD 50
KOSPI 200	KSE	0.05 points	KRW 500,000
MSCI Singapore	SGX	0.1 points	SGD 200
MSCI Taiwan	SGX	0.1 points	USD 100
Nikkei 225	OSE	10 points	JPY 1,000
Nikkei 225	SGX	5 points	JPY 500
OMXS30	OMX	0.25 points	SEK 100
S&P500 Globex®	CME	0.1 points	USD 250
SPI200	SFE	1 point	AUD 25
TOPIX	TSE	0.5 points	JPY 10,000
TAIEX	TFE	1 point	TWD 200

Note: This table reports contract specifications for each of the 15 stock index futures contracts examined in this study. *Exchange* is the main exchange on which the contract is traded, *minimum tick* is the minimum price increment, and *notional value per index point* is the dollar value (in local denominations) of each index point.